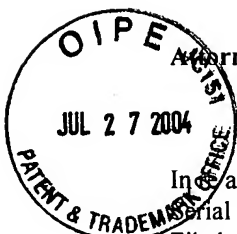


7/28/04

AF/T765/8#  
IHW



Attorney's Docket No. 67,200-624

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In application of: Chi-Wen Liu

Group Art Unit: 1765

Serial No.: 10/ 043,860

Examiner: Deo, Duy Vu Nguyen

Filed: Jan. 9, 2002

For: Method for Achieving a Uniform Material Removal Rate in a CMP Process

Commissioner for Patents  
Alexandria, VA 22313

TRANSMITTAL OF APPEAL BRIEF (PATENT APPLICATION-37 CFR 192)

1. Transmitted herewith, in triplicate, is the APPEAL BRIEF in this application, with respect to the Notice of Appeal filed on May 27, 2004.

NOTE: "The Appellant shall, within 2 months from the date of the notice of appeal under §1.191(a) or within the time allowed for response to the action appealed from, if such time is later, file a brief in "triplicate", 37 C.F.R. 1.192(a) [emphasis added].

2. STATUS OF APPLICANT

This application is on behalf of:

X other than a small entity.  
\_\_\_ a small entity.

A verified statement:

\_\_\_ is attached.  
\_\_\_ was already filed.

3. FEE FOR FILING APPEAL BRIEF

Pursuant to 37 CFR 1.17(f), the fee for filing the Appeal Brief is:

\_\_\_ small entity \$165.00  
X other than a small entity \$330.00

Appeal Brief fee due: \$ 330.00

Certificate of Mailing

I hereby certify that this correspondence is, on the date shown below, being:

Mailing

X deposited with the U.S. Postal Service  
with sufficient postage as Express Mail  
Label No. EV 531 645 407 US  
in an envelope addressed to Commissioner  
for Patents, Alexandria, VA 22313

Dated: July 27, 2004

4. EXTENSION OF TERM

NOTE: The time periods set forth in 37 CFR 1.192(a) are subject to the provision of § 1.136 for patent applications. 37 CFR 1.191(d). See also Notice of November 5, 1985 (1060 O.G. 27).

The proceedings herein are for a patent application and the provisions of 37 CFR 1.136 apply:

(complete (a) or (b), as applicable)

- (a) ☐ Applicant petitions for an extension of time under 37 CFR 1.136  
(fees: 37 CFR 1.17(a)-(d) for the total number of months checked below:

	Extension (months)	Fee for other than small entity	Fee for small entity
<input type="checkbox"/>	one month	\$ 110.00	\$ 55.00
<input type="checkbox"/>	two months	\$ 420.00	\$210.00
<input type="checkbox"/>	three months	\$ 950.00	\$475.00
<input type="checkbox"/>	four months	\$1,480.00	\$740.00

Fee: \$ \_\_\_\_\_

If an additional extension of time is required, please consider this a petition therefor.

(check and complete the next item, if applicable)

- ☐ An extension for \_\_\_\_\_ months has already been secured, and the fee paid therefor of \$ \_\_\_\_\_ is deducted from the total fee due for the total months of extension now requested.

Extension fee due with this request: \$ \_\_\_\_\_

or

- (b) ☐ Applicant believes that no extension of term is required. However, this conditional petition is being made to provide for the possibility that applicant has inadvertently overlooked the need for a petition and fee for extension of time.

5. TOTAL FEE DUE

The total fee due is:

Appeal Brief Fee: \$ 330.00  
Extension fee (if any) \$ \_\_\_\_\_

TOTAL FEE DUE: \$ 330.00

6. FEE PAYMENT

X Attached is a Credit Card Payment Form for the sum of \$ 330.00

A duplicate copy of this transmittal is attached.

7. FEE DEFICIENCY

NOTE: If there is a fee deficiency and there is no authorization to charge an account, additional fees are necessary to cover the additional time consumed in making up the original deficiency. If the maximum six-month period has expired before the deficiency is noted and corrected, the application is held abandoned. In those instances where authorization to charge is included, processing delays are encountered in returning the papers to the PTO Finance Branch in order to apply these charges prior to action on the cases. Authorization to charge the deposit account for any fee deficiency should be checked. See the Notice of April 7, 1986, 1065 O.G. 31-33.

  X   If any additional extension and/or fee is required, this is a request therefor  
to charge Visa Credit Card No. 4756 8461 9568 0263

And/Or

  X   If any additional fee for claims is required, please charge Visa Credit Card  
No. 4756 8461 9568 0263



\_\_\_\_\_  
Signature of Attorney

Registration No. 31,311

Telephone: (248) 540-4040

Randy W. Tung

Tung & Associates  
838 W. Long Lake Road, Ste. 120  
Bloomfield Hills, Michigan 48302



**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**  
**BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES**

Applicant: Chi-Wen Liu

Group Art Unit: 1765

Serial No.: 10/043,860

Examiner: Deo, Duy Vu Nguyen

Filed: 01/09/2002

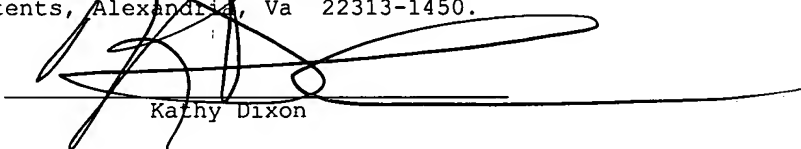
For: METHOD FOR ACHIEVING A UNIFORM MATERIAL REMOVAL RATE  
IN A CMP PROCESS

Attorney Docket No.: 67,200-624

**EXPRESS MAIL CERTIFICATE**

"Express Mail" label number EV 531 645 407 US  
Date of Deposit JULY 27/04

I hereby certify that this paper in triplicate and a credit card payment form in the amount of \$330.00 (required filing fee) are being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR \$1.10 on the date indicated above and is addressed to: Commissioner for Patents, Alexandria, Va 22313-1450.

  
Kathy Dixon

**APPEAL BRIEF**

Commissioner for Patents  
Alexandria, VA 22313-1450

Sir:

Appellant appeals in the captioned application from the Examiner's final rejection, dated 02/27/2004, of claims 1, 3-6, 9-13, 15-19 and 21.

It is urged that Examiners final rejection be reversed and that all the claims currently pending be allowed.

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**(1) REAL PARTY IN INTEREST**

The real party in interest in the present appeal is the recorded Assignee, Taiwan Semiconductor Manufacturing Company, Ltd.

**(2) RELATED APPEALS AND INTERFERENCES**

There are no other appeals or interferences that are known to the Appellant, the Appellant's legal representative, or the assignee.

**(3) STATUS OF CLAIMS**

Claims 1, 3-6, 9-13, 15-19 and 21 are pending in the application.

Claims 1, 3-6, 9-13, 15-19 and 21 stand rejected.

**(4) STATUS OF AMENDMENTS**

A Request for Reconsideration including proposed amendments was filed on or about 04/20/2004.

An Advisory Action from the Examiner was mailed on 4/30/2004 refusing entry of proposed amendments.

A Notice of Appeal was filed on or about 05/27/2004.

A supplemental amendment is being filed together with present Appeal Brief correct a grammatical error in claim 5 to put the claims in better form for Appeal and is listed in the Claim Appendix assuming entry of the supplemental amendment.

**(5) SUMMARY OF THE INVENTION**

The invention generally relates to chemical mechanical polishing and more particularly to a method for achieving a more uniform material removal rate in a chemical mechanical polishing (CMP) process (see page 1, 1<sup>st</sup> paragraph of the Specification). In particular, the invention provides a method for pre-etching a semiconductor wafer comprising tungsten oxide prior to a chemical mechanical polishing (CMP) process to achieve a uniform tungsten polishing rate including providing a wafer process surface having a layer of tungsten oxide overlying tungsten to be chemically mechanically polished; removing the layer of tungsten oxide according to an etching process selected from the group consisting of dry etching with a fluorocarbon etching chemistry and wet etching with a aqueous basic solution; cleaning the semiconductor wafer to include the wafer process surface according to a wet cleaning process; and, chemically mechanically polishing the wafer process surface according to a CMP process comprising applying at least an abrasive slurry to the wafer

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process surface. (See claim 1, Figures 2 and 3)

**(6) ISSUES**

1. Is the rejection of claims 1, 5, 6, 10-12, and 21 under 35 USC § 103(a) as being unpatentable over as being unpatentable over Torii (2002/0068451) and Miller et al. (US Pat No. 6,464,568), proper when such references do not teach or suggest APPELLANTS claimed invention or recognize or solve a problem in a way that APPELLANTS have recognized and solved by their claimed invention?

2. Is the rejection of claims 3, 4, 9, 13, and 15-19 under 35 USC § 103(a) as being unpatentable over Torii (2002/0068451) and Miller et al. (US Pat No. 6,464,568), and further in view of Manos (US 5,672,212) proper when such references do not teach or suggest APPELLANTS claimed invention or recognize or solve a problem in a way that APPELLANTS have recognized and solved by their claimed invention?

(7) GROUPING OF CLAIMS

The Claims do not stand and fall together:

1. Group I: Claims 1, 5, 6, 10-12, and 21.
2. Group II: Claims 3, 4, 9, 13, 15-19.

(8) ARGUMENTS

Issue 1

Is the rejection of claims 1, 5, 6, 10-12, and 21, under 35 USC § 103(a) as being unpatentable over Torii (2002/0068451) and Miller et al. (US Pat No. 6,464,568), proper when such references do not teach or suggest APPELLANTS claimed invention or recognize or solve a problem in a way that APPELLANTS have recognized and solved by their claimed invention?

Torii describes a method for removing tungsten oxide over tungsten prior to a tungsten polishing process (see abstract). Torii, however, unlike APPELLANTS disclosed and claimed invention discloses a **multi-step polishing process** for first removing the tungsten oxide and then polishing the tungsten (see e.g., paragraphs 0027 and 0028). In a different embodiment Torii discloses using a wet etching method by "immersing" the process surface in an "alkali aqueous solution" of sodium hydroxide **or** potassium hydroxide (paragraph 0033).



Torii also discloses a **sputter etch** method using **argon** to remove the tungsten oxide layer prior to polishing (paragraph 0034).

Torii does not disclose a dry etching method using fluorocarbons, or suggest that using fluorocarbons may be used to etch the tungsten oxide layer as claimed and disclosed by APPELLANTS in claims 1 and 13 and dependent claims 19 and 21.

Torii certainly does not teach dry etching the tungsten oxide layer with  $\text{CF}_4$  and oxygen as claimed in claims 19 and 21, but rather specifically teaches away for APPELLANTS disclosed and claimed invention by teaching a sputter etch process using argon. Nowhere does Examiner show a teaching or suggestion of dry etching a tungsten oxide layer with a fluorocarbon, and specifically a  $\text{CF}_4$  and oxygen containing etching chemistry, prior to a CMP process to improve to achieve a uniform tungsten polishing rate.

Moreover, Torii teaches away from APPELLANTS claimed invention by alternatively teaching (4 examples out of 6) a two-step polishing process, a problem which APPELLANTS disclose to be a problem in the prior art to be overcome. For example see the Specification at page 8 beginning at the last paragraph:

"One problem according to the prior art process is the difficulty in achieving the proper balance between tungsten oxide formation and tungsten oxide removal, thereby achieving a more uniform and efficient removal rate. For example, during the initial polishing period if a preformed tungsten oxide layer is present, being formed by ambient oxidation processes (aging), the material removal (polishing) rate is very slow **causing expensive slurry to be inefficiently consumed in the removal of the pre-formed tungsten oxide overlayer.**"

Examiner's only reference to the step of dry etching in claims 1 (and 13) and 21 (and 19) is the statement "claim 21 has no patentable weight since the claimed method for removing the oxide can be either a wet or dry etching, and Torii teaches using a wet etching". Examiner has not shown the fluorocarbon dry etching step in APPELLANTS claim 1.

APPELLANTS suggest Examiner is not properly addressing or reading the limitations present in APPELLANTS Markush type claim in claim 1 (and 13), and improperly dismissing one element of a Markush type claim without a showing of obviousness or equivalence with respect to each of the Markush elements.

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"In order to rely on equivalence as a rationale supporting an obviousness rejection, the equivalency must be recognized in the prior art, and cannot be based on applicant's disclosure or the mere fact that the components at issue are functional or mechanical equivalents." *In re Ruff*, 256 F.2d 590, 118 USPQ 340 (CCPA 1958) **(The mere fact that components are claimed as members of a Markush group cannot be relied upon to establish the equivalency of these components.** However, an applicant's expressed recognition of an art-recognized or obvious equivalent may be used to refute an argument that such equivalency does not exist.); *In re Scott*, 323 F.2d 1016, 139 USPQ.

Nowhere does Applicant recognize or suggest an art equivalency between wet etching and dry etching nor is Examiner's conclusory statement sufficient to establish a *prima facie* case of obviousness.

With respect to claim 1 (and 13), Torii further does not disclose a cleaning process prior to the CMP process following removal of the tungsten oxide.

With respect to claims 5, 6 (and 17, 18) Torii further **does not disclose a pH** for the alkali aqueous solution or for the generally disclosed "alkali aqueous solution" of sodium hydroxide

**or** potassium hydroxide (see paragraph 0033). Torii does not discuss or address the issues of different pH's for a particular etching solution, especially when agitation is present and whether there is a need for a subsequent cleaning process. Nowhere does Torii suggest or disclose the pH or even a range of pH as disclosed and claimed by Applicant for the specific use of KOH and water. Moreover, Torii teaches away from such a pH by teaching that a neutral pH slurry in a first polishing step to remove the tungsten oxide layer (see e.g., paragraphs 0027 and 0030).

"A prior art reference must be considered in its entirety, i.e., as a whole including portions that would lead away from the claimed invention." *W.L. Gore & Associates, Inc., Garlock, Inc., 721 F.2d, 1540, 220 USPQ 303 (Fed Cir. 1983), cert denied, 469 U.S. 851 (1984).*

"To establish prima facie obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art." *In re Royka, 490 F.2d 981, 180 USPQ 580 (CCPA 1974).*

Miller et al. disclose a CMP process **for copper**. Miller specifically discloses a pre-polish cleaning operation with a **complexing acid buffer system** on a CMP tool to remove copper

oxide (see e.g., Abstract and col 5, lines 35-52, lines 59-60)). The cleaning process is performed on a CMP tool process without oxidizers and abrasives (col 5, lines 59 - 62). Miller et al. teach that the pH of the cleaning solution including an **organic acid chelating agent** may be **ramped up over time** to the pH of the polishing slurry used in a subsequent CMP process (col 5, lines 62-66). Miller et al. teach that KOH may be **added as a buffer** to the organic acid to create a buffer system (col 6, lines 32-33). Miller discloses a pH of the pre-polish cleaning solution to be in the range of about 2.5 to 4 (see e.g., col 6, lines 35-38) but does not disclose a pH of the polishing slurry. Miller et al. teach in one embodiment, a rinse step, performed on the same CMP tool, between the CMP tool cleaning step and the abrasive CMP step **if the pH of the cleaning solution is higher than the pH of the polish slurry** to avoid slurry gelation (col 7, lines 1-6). Miller et al. also teach a post-CMP "scrubberless" cleaning operation on the CMP polishing tool (col 6, lines 15-19).

There are no teachings present in Miller et al. that help Examiner in establishing a *prima facie* case of obviousness. For example, Miller et al. **discloses an optional cleaning process** following a copper oxide removal (etching) process **under certain circumstances of pH** (i.e., if the pH of the **acidic** cleaning

solution is **higher** than the pH of the polish slurry to avoid slurry gelation).

With respect to claims 1 (and 13), 5 and 6 (and 17 and 18), Miller et al. affirmatively teach away from APPELLANTS disclosed and claimed invention in a number of respects. Miller al. discloses using an **acid cleaning solution** in a **pre-polish cleaning operation** for removing **copper oxide**.

With respect to claims 1 (and 13) and 21 (and 19), Miller et al teach away from using a fluorocarbon dry etching process, including one comprising CF<sub>4</sub> and oxygen, by teaching a wet etching process with an organic acid buffer system.

With respect to claim 1 (and 13), Miller et al. teach away from APPELLANTS disclosed and claimed invention by teaching a cleaning process (**on the CMP polishing tool**), **only** if the pH of the cleaning solution is higher than the pH of the polish slurry to avoid slurry gelation (col 7, lines 1-6).

With respect to claims 10 and 11, nowhere do Torii and Miller teach "wherein the CMP process further includes applying a polishing solution to the wafer process surface for forming an oxide layer in-situ over the tungsten". Rather, Torii discloses

a two step CMP polishing process where the first CMP process is carried out with no oxidant and the second CMP process is carried out with an oxidant. Yet nowhere does Torii teach that an oxide layer is formed in-situ over the tungsten in the CMP polishing process which would clearly defeat the principal of operation in the first CMP process of Torii (see e.g., paragraph 0031).

With respect to claim 12, APPELLANTS repeat the comments made above with respect to claim 1.

Further, there is no apparent reason for combining the teachings of Miller et al and Torii et al. since they are directed at different inventions and methods for removing different types of oxides (copper oxide versus tungsten oxide) using different solutions (e.g., organic acid versus basic NaOH or KOH) prior to a CMP polishing process. There is no reason to expect the method for removing copper oxide disclosed by Miller et al. would be successful in the process of Torii for removing tungsten oxide.

Examiner asserts that Torii "teaches the metal film to be polish can be W, Al, Cu, or the like". Rather, Torii merely discloses that metal films in prior art CMP polishing processes in general may be W, Al, Cu, or the like (see paragraph 006).

Torii dose not discuss or disclose a process to remove copper oxide or aluminum oxide. Rather the two processes of Torii and Miller et al. are incompatible since Torii discloses a basic alkali solution for tungsten oxide removal and Miller et al teaches an organic acid buffer system for copper oxide removal.

Nevertheless, even assuming proper motive for combination, such combination does not produce APPELLANTS disclosed and claimed invention, but rather specifically teaches way therefrom.

"First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. **Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.** The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure." *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).



**Issue 2**

Is the rejection of claims 3, 4, 9, 13, and 15-19 under 35 USC § 103(a) as being unpatentable over Torii (2002/0068451) and Miller et al. (US Pat No. 6,464,568), and further in view of Manos (US 5,672,212) proper when such references do not teach or suggest APPELLANTS claimed invention or recognize or solve a problem in a way that APPELLANTS have recognized and solved by their claimed invention?

With respect to claims 13, and 17-19, APPELLANTS reiterate the comments made above with respect to Torii and Miller et al. under Issue 1.

Manos discloses a method and apparatus for cleaning or etching batches of wafers where the wafers are placed in a wafer carrier and are immersed in a megasonically agitated cleaning tank whereby the wafer carrier is simultaneously rotated while applying megasonic energy (see Abstract).

With respect to claims 3 and 4, 13 and 16, nowhere does Miller al. or Torii disclose a wet etching process while simultaneously agitating the process surface as APPELLANTS have claimed, or applying megasonic energy or brushing during etching tungsten oxide with an aqueous basic solution. Rather, both Torii and Miller et al. specifically teach away from APPELLANTS

disclosed and claimed invention. For example Torii specifically teaches an "immersion" process" (see paragraph 0033) for tungsten oxide removal and Miller et al. specifically teaches using a "scrubberless" CMP tool in the copper oxide removal process.

While one may argue (Examiner has not so argued) that the copper oxide removal process of Miller et al. using a CMP polishing tool "agitates" the process surface, APPELLANTS do not concede that "agitating" the process surface as APPELLANTS have disclosed and claimed is equivalent to a CMP polishing process, and Examiner has not shown such equivalency or argued such an equivalency. Moreover, the etching (copper oxide) removal process of Miller et al., carried out with an acidic solution on a CMP polishing tool prior to polishing (even including the cleaning step), would defeat a purpose of APPELLANTS disclosed and claimed invention by inducing scratching of the process surface from tungsten oxide particles.

Moreover, there appears to be no specific motivation to combine the teachings of Manos et al with either Miller et al. or Torii. Manos does not disclose wet etching metal oxide prior to a CMP process or disclose a brushing process, or disclose acid or basic etchant solutions. Further, Manos does not disclose or suggest a cleaning process following an etching process. Neither

Torii nor Miller et al. suggest that a megasonic or brushing cleaning process would be beneficial or advantageous in their disclosed cleaning processes. Rather, both Torii and Miller et al. specifically teach away from APPELLANTS disclosed and claimed invention as noted above.

Nevertheless, even assuming *arguendo* a proper motive for combining the teachings of the cited references, such combination does not produce APPELLANTS claimed invention. Rather, the motivation for combining the references appears to be impermissible hindsight reasoning using APPELLANTS disclosure as a roadmap to re-create APPELLANTS disclosed and claimed invention.

With respect to claim 9, nowhere do Torii, Miller et al., or Manos disclose or teach a cleaning process following the wet etching process including dipping or spraying while simultaneously agitating the wafer process surface as APPELLANTS have disclosed and claimed.

With respect to claim 15, nowhere do Torii, Miller et al., or Manos suggest or disclose an etching process with an aqueous basic solution of tungsten oxide while simultaneously agitating the process surface "wherein the wet etching process is selected

from the group consisting of dipping into the aqueous basic solution and spraying the aqueous basic solution onto the wafer process surface". While Torii discloses an immersion process, nowhere is agitation of the process surface or spraying of the process surface suggested or taught.

APPELLANTS reiterate the comments made above under issue I with respect to claims 17, 18, and 19.

"The fact that references relied upon teach that all aspects of the claimed invention were individually known in the art is not sufficient to establish a prima facie case of obviousness without some objective reason to combine the teachings of the references." *Ex parte Levengood*, 28 USPQ2d 1300 (Bd. Pat. App. & Inter. 1993).

**"Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure."** *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991) Emphasis added.

"We do not pick and choose among the individual elements of assorted prior art references to recreate the claimed invention, but rather we look for some teaching or suggestion in the references to support their use in a particular claimed combination" *Symbol Technologies, Inc. v. Opticon, Inc.*, 935 F.2d 1569, 19 USPQ2d 1241 (Fed. Cir. 1991).

#### **CONCLUSION**

Examiner has not met the required burden of establishing a *prima facie* case of obviousness and moreover, APPELLANTS disclosed and claimed invention has been demonstrated to be nonobvious. None of the cited references individually or in combination recognizes and solves the problem of pre-etching a semiconductor wafer comprising tungsten oxide prior to a chemical mechanical polishing (CMP) process to achieve a uniform tungsten polishing rate in the manner that APPELLANTS have disclosed and claimed. In particular, Examiner has not shown in the prior art the wet etching or fluorocarbon dry etching process that APPELLANTS have claimed. Rather the references either specifically teach away from APPELLANTS invention or would destroy the purpose and effect of APPELLANTS disclosed and claimed invention. The fact that Examiner can produce no references disclosing or suggesting APPELLANTS disclosed and

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claimed invention strongly supports a conclusion of nonobviousness.

It is therefore respectfully submitted that Examiners final rejection of Appellants claims is improper under the statutory standard of 35 USC § 103(a) as interpreted by both the Board and the Courts.

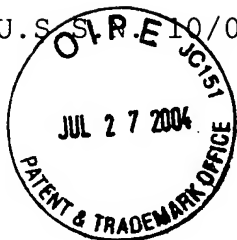
The reversal of the final rejection is respectfully solicited from the Board.

Respectfully submitted,

Tung & Associates

By: 

Randy W. Tung  
Registration No. 31,311  
Telephone: (248) 540-4040



CLAIM APPENDIX

1. A method for pre-etching a semiconductor wafer comprising tungsten oxide prior to a chemical mechanical polishing (CMP) process to achieve a uniform tungsten polishing rate comprising the steps of:

providing a wafer process surface having a layer of tungsten oxide overlying tungsten to be chemically mechanically polished;

removing the layer of tungsten oxide according to an etching process selected from the group consisting of dry etching with a fluorocarbon etching chemistry and wet etching with a aqueous basic solution;

cleaning the semiconductor wafer to include the wafer process surface according to a wet cleaning process; and,

chemically mechanically polishing the wafer process surface according to a CMP process comprising applying at least an abrasive slurry to the wafer process surface.

2. cancelled

3. The method of claim 1, wherein the wet etching process comprises simultaneously agitating the wafer process surface.

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4. The method of claim 3, wherein agitating the wafer process surface is selected from the group consisting of megasonic energy and brushing.

5. The method of claim 1, wherein the aqueous basic solution has a pH of greater than about 10.

6. The method of claim 5, wherein the aqueous basic solution consists essentially of potassium hydroxide (KOH) and water.

7. cancelled

8. cancelled

9. The method of claim 1, wherein the wet cleaning process comprises using deionized water wherein the wafer process surface is subjected to at least one of dipping into the deionized water and spraying the deionized water onto the wafer process surface while simultaneously agitating the wafer process surface.

10. The method of claim 1, wherein the CMP process further includes applying a polishing solution to the wafer process surface for forming an oxide layer in-situ over the tungsten.



11. The method of claim 10, wherein the polishing solution comprises hydrogen peroxide.

12. The method of claim 1, further including a wafer process surface cleaning step following the step of chemically mechanically polishing.

13. A method for pre-etching a semiconductor wafer comprising tungsten oxide prior to a chemical mechanical polishing (CMP) process to achieve a uniform tungsten polishing rate comprising the steps of:

providing a wafer process surface having a layer of tungsten oxide overlying tungsten to be chemically mechanically polished;

removing the layer of tungsten oxide according to an etching process selected from the group consisting of dry etching comprising a fluorocarbon etching chemistry and wet etching comprising an aqueous basic solution while simultaneously agitating the process surface;

cleaning the semiconductor wafer to include the wafer process surface according to a wet cleaning process comprising agitating the process wafer surface; and,

chemically mechanically polishing the wafer process surface according to a CMP process comprising applying at least an abrasive slurry to the wafer process surface.

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14. cancelled

15. The method of claim 13, wherein the wet etching process is selected from the group consisting of dipping into the aqueous basic solution and spraying the aqueous basic solution onto the wafer process surface.

16. The method of claim 13, wherein agitating the wafer process surface includes at least one of megasonic energy and brushing.

17. The method of claim 13, wherein the aqueous basic solution has a pH of greater than about 10.

18. The method of claim 17, wherein the aqueous basic solution consists essentially of potassium hydroxide (KOH) and water.

19. The method of claim 13, wherein the dry etching process comprises a reactive ion etch process comprising  $\text{CF}_4$  and oxygen.

20. cancelled

21. The method of claim 1, wherein the dry etching process comprises a reactive ion etch process comprising  $\text{CF}_4$  and oxygen.